First mock-up of the CBM STS module based on a new assembly concept

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The first mock-up of the CBM STS detector module based on a modified design and new assembly concept has been developed and manufactured by the Kharkov team at the newly created assembly site of LTU Ltd.

Composition of the detector module mock-up

The initial module concept [1, 2] foresaw multi-layered cables comprising 512 traces at each signal layer. Based on the experience obtained in the prototyping stage and taking into account risk minimization and yield increase with the manufacture and assembly of components a new design and assembly concept was suggested [3]. The module mock-up was developed for verification of this concept. It includes the following components, similar as in real full-scale modules:

- dummy microstrip double sided sensor (1024 strips on each side at 58 um pitch, 7.5° stereo angle of strips);
- prototypes of multilayered connection microcables (1024 lines for one side of sensor);
- dummy chips with 128 input pads;
- dummy FEBs with 8 seats for chips.

A microcable consists of the following layers:

- eight multilayered microcables (128 lines for chip to sensor connection). Each multilayered cable includes two connecting layer (FDI-A-24, 64 traces at 113 μm pitch) and meshed spacers (Kapton 50 μm thick, fill factor about 40%).
- overall meshed spacer for all 8 multilayered microcables (Kapton 100 μm thick or two spacers 50 μm thick, fill factor about 40%).
- overall shielding layer for all 8 multilayered microcables (FDI-A-24) with glued meshed spacer (Kapton 50 μm thick, fill factor about 40%).

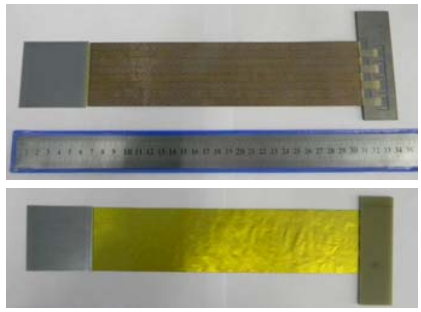
Assembly sequence of mock-up

For the first detector module mock-up the following technological sequence has been developed:

1. Assembly (gluing) of multilayered components (connecting and shielding layers with spacers).
2. SpTAB bonding bottom connecting cables to chips, bond joints protecting.
3. SpTAB bonding top connecting cables to chips, bond joints protecting.
4. Aligning of sensor sides of the top and bottom cables and cables gluing (fixing precise aligned position one to each other).
5. Aligning of sensor sides of 8 assembled multilayered connecting cables to sensor.
6. Gluing of overall meshed spacer or shielding layer (depending on modules side).
7. Mounting (gluing, wire bonding, encapsulating) of assembled multilayered cable with chips to the FEB (first 4 chips than second 4 chips),
8. Multilayered cables (mounted on the FEB) SpTAB bonding to the sensor (bottom cables, then top cables), bond joints protecting,
9. Flipping the assembled half-module upside down,
10. Repetition of operations 7 and 8 for second side.

Module mock-up manufacturing

For the first module mock-up were developed and produced more than 10 types of component requiring more than 20 photomasks. As a result of abovementioned works the first half-module (only one sensor side connected, without wire bonding chip-to-FEB) was assembled (Fig. 1).



a)

b)

Figure 1: First mock-up of the CBM STS detector half-module a) top view, b) bottom view.

During the assembly of the first module mock-up only visual inspection were performed but for real detector modules after each bonding of connecting layers to sensors or chips need to be done electrical QA testing.
Results of development and assembling of the first mock-up of the CBM STS half-module confirm practical feasibility of suggested concept on detector modules creation.

References

[1] V.M. Borshchov et al., CBM Progress Report 2009, p 17

[2] Yu.A.Murin et al., CBM Progress Report 2011, p 19

[3] C.J. Schmidt et al., CBM Progress Report 2012, p 18